CLAIMS

1. A microfluidic valve comprising a first body for containing fluid having a fluid inlet and a fluid outlet and a plurality of electrodes, and arranged to contain, in use, a second body held within fluid contained in the first body, the second body being moveable toward or away from one of the fluid inlet or fluid outlet, the movement of the second body caused by a phase difference in the electric field generated by the electrodes, such that fluid flow into or out of the first body is controlled.

2. The microfluidic valve of claim 1, wherein the plurality of electrodes is an array.

3. The microfluidic valve of claim 1 or 2, wherein the plurality of electrodes are arranged on a side of the first body.

4. The microfluidic valve of claims 1, 2 or 3, wherein the plurality of electrodes are arranged on opposite sides of the first body.

5. The microfluidic valve of claims 1, 2 or 3, wherein the plurality of electrodes are arranged on adjacent sides of the first body.

6. The microfluidic valve of any of claims 1 to 5, wherein the phase difference is produced by an electric field gradient created by applying alternating current to the plurality of electrodes.

7. The microfluidic valve of any of claims 1 to 5, wherein the phase difference is produced by a non-uniform electric field created by applying alternating current to the plurality of electrodes.

8. The microfluidic valve of claim 6, wherein the phase difference is a phase lag of 90°.

9. The microfluidic valve of claim 7, wherein the phase difference is a phase advance of 90°.

10. The microfluidic valve of any of claims 1 to 9, wherein the phase difference causes the second body to move toward or away from one of the fluid inlet or fluid outlet.

11. The microfluidic valve of any preceding claim, wherein when the second body is moved toward one of the fluid inlet or fluid outlet, fluid flow into or out of the body is prevented.

12. The microfluidic valve of claim 11, wherein when fluid flow is prevented, the valve is switched off.

13. The microfluidic valve of claim 10, 11 or 12, wherein when the second body is moved away from one of the fluid inlet or fluid outlet, the vale is on.

14. The microfluidic valve of any preceding claim, wherein the second body is of a dielectric material.

15. The microfluidic valve of claim 14, wherein the dielectric material is one of latex, polystyrene, polypropylene, glass, silica or PTFE.

16. The microfluidic valve of any of claims 1 to 13, wherein the second body is a bubble.

17. The microfluidic valve of claim 16, further comprising a bubble generation chamber with an opening into the body.

18. The microfluidic valve of any preceding claim, wherein the first body defines a chamber.

19. The microfluidic body of any of claims 1 to 17, wherein the first body defines a channel.

20. The microfluidic valve of claim 19, wherein the channel is a pipe.

21. The microfluidic valve of any preceding claim, wherein the second body is moveable in the electric field by dielectrophoresis.

22. The microfluidic valve of any of claims 1 to 13, wherein the second body is electrically conductive.

23. The microfluidic valve of claim 22, wherein the second body is moveable in the electric field by electrophoresis.

24. The microfluidic valve of any of claims 1 to 20, wherein the second body is moveable in the electric field by electro-osmosis.

25. The microfluidic valve of any preceding claim, wherein the fluid flow is laminar.

26. The microfluidic valve of any preceding claim, wherein the first body has a plurality of inlets.

27. The microfluidic valve of any of claims 1 to 26, wherein the first body has a plurality of outlets.

28. The microfluidic valve of claim 26 or 27, wherein the fluid flow through each inlet or each outlet is controllable.

29. The microfluidic valve of any preceding claim, wherein the second body controls fluid flow through a fluid inlet.

30. The microfluidic valve of any of claims 1 to 28, wherein the second body controls fluid flow through a fluid outlet.

31. The microfluidic valve of any preceding claim, wherein the fluid is a liquid.

32. The microfluidic valve of any of claims 1 to 31, wherein the fluid is a gas.

33. A method of controlling fluid flow is a microfluidic valve comprising:

applying a voltage to a plurality of electrodes arranged on a first body containing fluid, the body having a fluid inlet and a fluid outlet thereby creating an electric field; and

causing a second body to move, due to a phase difference in the electric field induced between adjacent electrodes, toward or away from one of the fluid inlet or fluid outlet.

34. The method of claim 33, wherein the plurality of electrodes is an array.

35. The method of claim 33, wherein an alternating current is applied to the electrodes.

36. The method of any of claims 33, 34 or 35, wherein the phase difference is a phase lag of 90°.

37. The method of any of claims 33, 34 or 35, wherein the phase difference is a phase advance of 90°.

38. The method of any of claims 33 to 37, wherein the phase difference causes the second body to move toward or away from one of the fluid inlet or fluid outlet.

39. The method of claim 38, wherein when the second body is moved toward one of the fluid inlet or fluid outlet, fluid flow into or out of the first body is prevented.

40. The method of claim 39, wherein when fluid flow is prevented, the valve is switched off.

41. The method of any of claims 33 to 38, wherein when the second body is moved away from one of the fluid inlet or fluid outlet, the valve is switched on.

42. The method of any of claims 33 to 41, wherein the second body is of a dielectric material.

43. The method of claim 42, wherein the dielectric material is one of latex, polystyrene, polypropylene, glass, silica of PTFE.

44. The method of any of claims 33 to 42, wherein the second body is a bubble.

45. The method of claim 44, further comprising generating the bubble in a bubble generation chamber which opens onto the first body.

46. The method of claim 45, further comprising introducing the bubble into the first body.

47. The method of claim 46, wherein the bubble is introduced into the first body before applying alternating current to the plurality of electrodes.

48. The method of claim 46, wherein the bubble is introduced into the first body after applying alternating current to the plurality of electrodes.

49. The method of any of claims 33 to 48, wherein the second body is moveable in the electric field by dielectrophoresis.

50. The method of any of claims 33 to 49, wherein the second body is an electrically conductive particle.

51. The method of claim 50, wherein the second body is moveable in the electric field by electrophoresis.

52. The method of any of claims 33 to 48, wherein the second body is moveable in the electric field by electro-osmosis.

53. A microfluidic chip comprising the microfluidic valve of any of claims 1 to 32.

54. A microfluidic switch comprising the microfluidic valve of any of claims 1 to 32.

55. The method of claim 33, wherein the electric field is non-uniform.

56. The method of claim 33, wherein the electric field has an electric field gradient.

57. A diagnostic device comprising the microfluidic chip of claim 55 or the microfluidic switch of claim 56.

58. A microfluidic valve substantially as herein described and with reference to figures 2 to 6 of the accompanying drawings.

59. A method of controlling fluid flow substantially as described herein and with reference to figures 2 to 6 of the accompanying drawings.